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Front cover photography: Exploration of the collapse dolines, such as the one at the Small Natural Bridge in Rakov Škocjan, has enabled a deeper understanding of karst processes in recent years (photograph: Matej Lipar).
Fotografija na naslovnici: Raziskave udornice, kot je ta pri Malem Naravnem mostu v Rakovem Škocjanu, so v zadnjih letih omogočile globlje razumevanje kraških procesov (fotografija: Matej Lipar).

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HOUSEHOLD EARTHQUAKE PREPAREDNESS IN SERBIA: A STUDY OF SELECTED MUNICIPALITIES

Vladimir M. Cvetković, Kevin Ronan, Rajib Shaw, Marina Filipović, Rita Mano, Jasmina Gačić, Vladimir Jakovljević

MILOŠ CVETKOVIĆ

Aftermath of the Kraljevo earthquake.

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Household earthquake preparedness in Serbia: A study of selected municipalities

ABSTRACT: This article presents the results of a qualitative study of household earthquake and community-level preparedness in Serbia and its relationship to various demographic factors. A series of 1,018 face-to-face interviews were conducted at the beginning of 2017 in eight Serbian municipalities. The results show that the population is generally unprepared, with low percentages of reported enhanced preparedness levels. In addition to presenting its findings, the study also considers future research directions, including using this study as a basis for more detailed research and to assist in facilitating community-led programs and strategies to increase earthquake safety.

KEY WORDS: geography, natural hazards, earthquake, preparedness, household, survey, Serbia

Pripravljenost gospodinjstev na potrese v Srbiji: Študija izbranih občin

IZVLEČEK: V članku so predstavljeni rezultati kvalitativne študije pripravljenosti na potres v gospodinjstvih in na občinski ravni v Srbiji in njeni povezanosti različnimi demografskimi dejavniki. Članek temelji na 1018 intervjujih, ki so bili izvedeni na začetku leta 2017 v osmih srbskih občinah. Rezultati kažejo, da je prebivalstvo na splošno nepripravljeno, z nizkim deležem izboljšane ravni pripravljenosti. Poleg lastnih ugotovitev študija obravnava tudi prihodnje smeri raziskovanja, vključno z uporabo te študije kot temelja za podrobnejše raziskave in za pomoč pri programih, ki jih vodijo skupnosti, ter strategij za povečanje potresne varnosti.

KLJUČNE BESEDE: geografija, naravne nesreče, potres, pripravljenost, gospodinjstvo, raziskovanje, Srbija

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1 Introduction

Disasters caused by earthquakes present various threats to human society and are generally seen as processes resulting from the interaction between natural and anthropogenic systems (Lukić et al. 2013). The preparedness of individuals, households, and communities is very important for improving community resilience in the face of any natural hazards, especially with regard to modern society's great vulnerability to earthquakes (Komac et al. 2013). Disaster preparedness is defined as self-protective or precautionary behavior (Mishra and Suar 2012), but preparedness activities are usually not engaged in at the household level (e.g., Eisenman et al. 2006; Kapucu 2008; Bethel, Foreman, and Burke 2011; Marti et al. 2018). More recent studies have highlighted the factors associated with earthquake preparedness at the household and community levels (Murphy et al. 2009; FEMA 2009; Johnston, Becker and Paton 2012; Muttarak and Pothisiri 2013; Paton et al. 2015; Cvetković et al. 2015; Deyoung and Peters 2016; Johnson and Nakayachi 2017; Fox et al. 2017). First, demographic and socioeconomic variables are a central set of characteristics linked to preparedness. Older, female, and better-educated heads of households, as well as residence duration, tend to be associated with better household preparedness (Duval and Mulilis 1999; Shaw et al. 2004). On the other hand, better community preparedness has been associated with non-single status and farming occupations (Tomio et al. 2014; Ashida et al. 2017). Second, recent studies (Kirschenbaum 2006; Tomio et al. 2014) have found that the relationship between household and community preparedness is not complementary, and, as a result, a large proportion of households are unprepared at both the community and household levels (Kirschenbaum, Rapaport and Canetti 2017). In practice, disaster management authorities often do not implement any activities related to earthquake preparedness at local levels, and they focus more on reactive and top-down approaches (Ainuddin and Routray 2012).

This study gathered basic data necessary for understanding preparedness and for use in preparedness planning and programs. Proceeding from this basis, it examined preparedness perceptions, knowledge, and behaviors, including investigation of the role of demographic factors (sex, age, education level, marital status, and household income) influencing household earthquake preparedness in Serbia. Such variations reflect the extent to which factors can shape community-driven efforts and education, supporting efforts to prepare for and cope with an earthquake. Based on the findings, the article suggests some specific initiatives that can be taken to improve preparedness in Serbia.

2 Study area

Serbia belongs to a region with moderate seismic activity in terms of the number and frequency of earthquakes as well as their magnitude, and it is characterized by an irregular distribution of epicenters, which makes it difficult to distinguish seismically active faults (Marović et al. 2002; Abolmasov et al. 2011; Dragicević et al. 2011). Marović et al. (2002) found that, from 1900 to 1970, stronger-intensity earthquakes (determined as I = VIII–IX) were registered at the following locations: Rudnik (a mountain), Lazarevac (a municipality of the city of Belgrade), Juhor (a mountain), Krupanj (a town and municipality in the Mačva district of western Serbia), Jagodina (a city and the administrative center of the Pomoravlje district in central Serbia), Vranje (a city and the administrative center of the Pčinja district in southern Serbia), and Vitina (a town and municipality in eastern Kosovo), and, from 1970 onwards, only three moderate-intensity earthquakes have occurred: at Kopaonik (a mountain), Mionica (a town and municipality in the Kolubara district of western Serbia), and Trstenik (a town and municipality in the Rasina district of central Serbia).

The most seismically threatened is Lazarevac, where an extreme earthquake (M = 6.1) was recorded in 1922. Near the city of Kraljevo, Serbia, with a population of more than 100,000, an M = 5.4 earthquake occurred on November 3rd, 2010. Over the next six days, 258 earthquakes were registered, with magnitudes ranging from 1.0 to 4.4. Despite the moderate magnitude of the incident, two people were killed, many others were injured, and the total damage to the city was assessed at more than €100 million (Panić et al. 2013). By the end of March 2011, the earthquake had been followed by a sequence of more than 650 aftershocks of a magnitude greater than 1.0 (Antonijević, Arroucanu and Vlahović 2013).

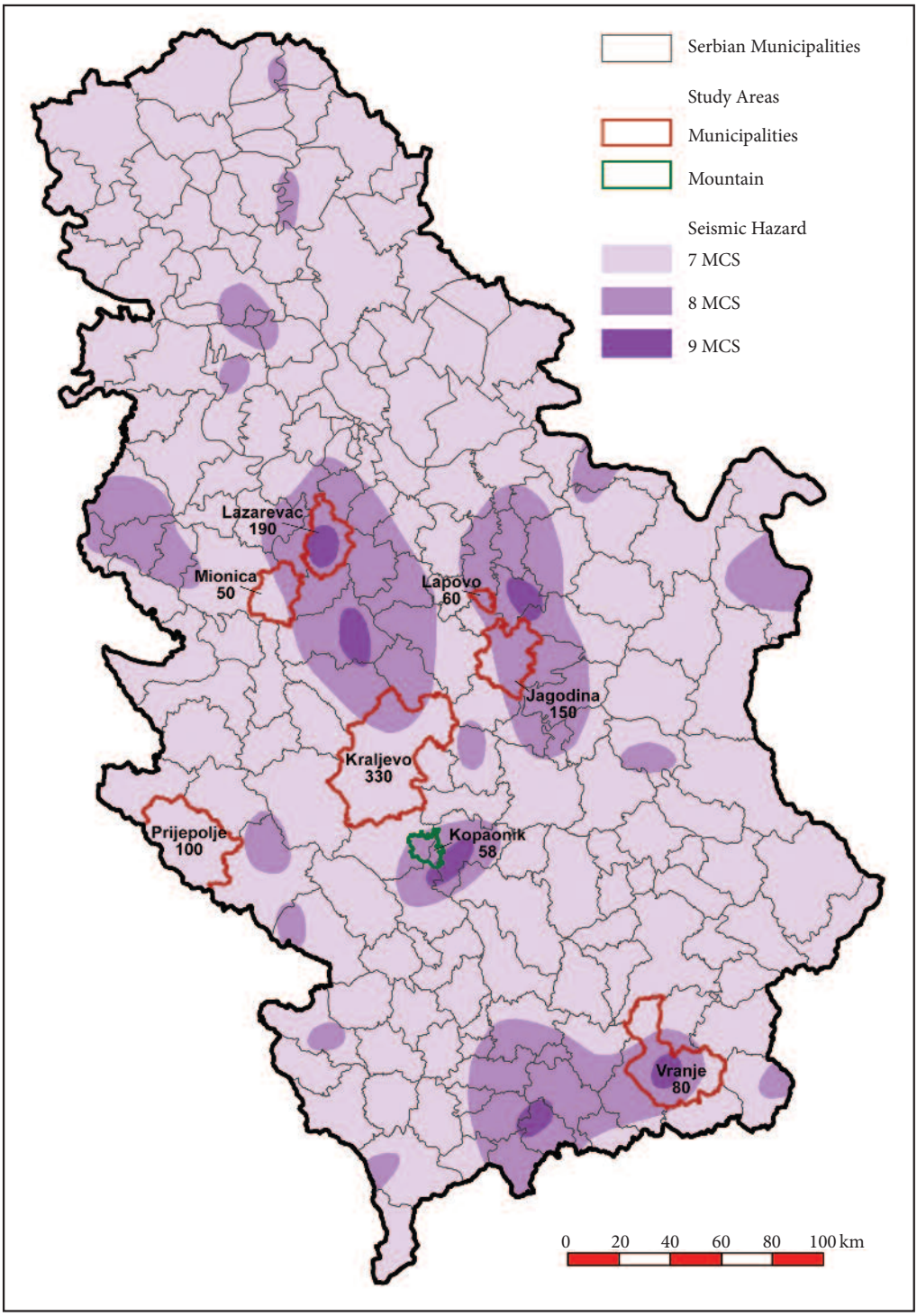

Figure 1: Earthquake intensity zones (hundred-year return period) in Serbia and the number of respondents in the municipalities studied.

3 Methods

Preparedness research investigates individuals' perceived readiness before a disaster event and takes into account all mitigation actions and response behaviors in the aftermath of the emergency (Mulilis and Lippa 1990; Paton 2003). With regard to preparedness, the following dimensions were examined: perceived preparedness and household safety (Dooley et al. 1992; Levac, Toal-Sullivan and O'Sullivan 2012), storage of emergency food and supplies (Baker 2011), knowledge and availability of shelter (Kohn et al. 2012), and special support and assistance (Flynn et al. 1999). A series of 1,018 face-to-face interviews were conducted at the beginning of 2017 in eight of Serbia's 150 municipalities. These communities were chosen with reference to the national map of seismic regionalization of Serbia with a return period of one hundred years (Vukasinović 1987) and their various demographic and social characteristics. The participants in these municipalities were selected randomly, with the number of respondents proportional to their size (0.2–0.9%), thus providing a random selection and a representative sampling approach (Paul and Bhuiyan 2010). The communities where the interviews took place were Kraljevo (330), Lazarevac (190), Jagodina (150), Mionica (fifty), Vranje (eighty), Prijepolje (one hundred), Lapovo (sixty and Kopaonik (fifty-eight; Figure 1). Using a multistage random sample, in the first stage we singled out these communities, and then in the second stage we selected particular streets and parts of the streets. Finally, we selected various households, where the survey was conducted. The respondents were determined based on a random selection procedure of adult household members, where an individual over eighteen was interviewed and presented with a structured questionnaire.

3.1 Survey instruments

A structured questionnaire was set up using a combination of qualitative (close-ended) multiple-choice questions and five-point Likert scales (Joshi et al. 2015). The first part of the questionnaire is related to the demographic and socioeconomic characteristics of the interviewees (e.g., sex, age, and level of education). Subsequent sections included questions relating to perceived preparedness and household safety (variables about household preparedness, community preparedness, geological layers under the house, earthquake-proof houses, reinforced houses, furniture secured to walls, and well-reinforced houses), essential supplies (variables about a prepared emergency kit, examination of the contents of the emergency kit, easy access to the emergency kit, possession of a sufficient emergency stock, and community-stored emergency supplies), shelter (variables about designated shelter nearby, familiarization with the route to the shelter, obstacles on the route to the shelter, alerting neighbors before evacuation, the state of the shelter, and familiarization with the management of shelters), and special support and assistance (variables about special care in cases of disaster, knowledge about situations when the dead and injured are elderly, difficulties in evacuating family members, dealing with the elderly, handicapped, and infants, knowledge about guiding the hearing or visually impaired, and familiarization with kinds of support for the elderly). Each item was rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The items here were developed after consulting several published survey approaches (Mulilis, Duval and Lippa 1990; Matsuda and Okada 2006; Spittal et al. 2006; Ardalan and Sohrabizadeh 2016). A pilot pre–test of the questionnaire was also conducted in Belgrade to check the comprehension and performance of the questionnaire.

3.2 Sample

The interviewees, 46.9% women and 50.1% men (97% fully completed the questionnaire), were representative of the sex stratification of Serbian population, with 51.3% women and 48.7% men. The average age of respondents was 36 (population average: 42.6), and the largest category was those under 36. The sample implies that the majority of respondents had a secondary education (population average: primary 20.76%, secondary 48.93%, and associate's degree 15.1%, according to Statistical Office of the Republic of Serbia). In the household sample, married people accounted for 45% of the sample (population average: single 27.91%, married 55.12%, widowed 11.64%, and divorced 4.93%). The majority of respondents were unemployed (population average: employed 29.3%), and the monthly income at the family level was reported to be up

to €750 (population average: €480). The interviewees also had different homeownership statuses: family member (61.1%), owners (29.7%), and rented (8.8%; Table 1).

Table 1: Socioeconomic and demographic information of respondents (number of responders).

Variable and number of respondents	Category	*n*	%
Sex (1,016)	Male	476	46.9
	Female	540	50.1
Age (1,018)	Young (18–38)	564	46.6
	Middle-aged (39–60)	354	34.7
	Elderly (over 60)	100	9.8
Education level (644)	Primary	12	1.2
	Secondary	294	28.9
	Associate's degree	102	10.0
	Bachelor's degree	194	19.1
	Graduate degree	42	4.1
Marital status (786)	Single	294	28.9
	Married	458	45.0
	Divorced	30	2.9
	Widowed	4	0.4
Homeownership (1,014)	Personal	302	29.7
	Family member	622	61.1
	Rented	90	8.8
Employment status (1,014)	Employed	442	43.4
	Unemployed	572	56.2
Monthly family income (€, 1018)	Up to 210	152	14.9
	Up to 420	304	29.9
	Up to 630	382	37.5
	Up to 750	130	12.8
	Over 751	50	4.9

4 Results

4.1 Perceived preparedness and household safety

In terms of preparedness levels, the mean estimate of households' preparedness was 3.02 out of 5, and for the local community 2.76 out of 5. In categorical terms, these mean scores reflect approximately the midpoint on a five-point Likert scale, and in this case endorsement centered around 3, »neither prepared nor unprepared.« Thus, in terms of categorical placement, the highest percentage of respondents said that their household is neither prepared nor unprepared to respond (39.5%), 31.5% stated prepared, and 29.0% said they were unprepared to respond. Focusing on the perceptions of community preparedness and translating the mean score of 3.02 in categorical terms, the largest percentage of respondents (44.0%) reported that the local community is unprepared for reaction, 33.2% stated neither prepared nor unprepared, and 22.8% said they were prepared to respond. The largest percentage of respondents (54.9%) reported having no knowledge of the geology under the house. In terms of buildings being reinforced, 40.0% reported that they do not know whether the buildings are reinforced against an earthquake (Figure 2).

Considering differences in gender roles and responsibilities, males were found to have higher percentages in the following categories: perception that their households were prepared, that the local community was

prepared, that they knew what kind of geological layers existed under the house, and that they were more likely to reinforce buildings. In contrast, women were found to have higher percentages in the following areas: they checked their houses for earthquake resilience, reinforced the house, and secured furniture (Table 2).

In terms of age, the results show that, compared to the middle-aged and elderly, young people had higher percentages in the following categories: that the household and local community was prepared, that the house was checked for earthquake resilience, that they secured furniture, and that they reinforced buildings. Compared to middle-aged and young people, elderly people reported higher percentages of awareness about what kind of geological layers were under the house (Table 2).

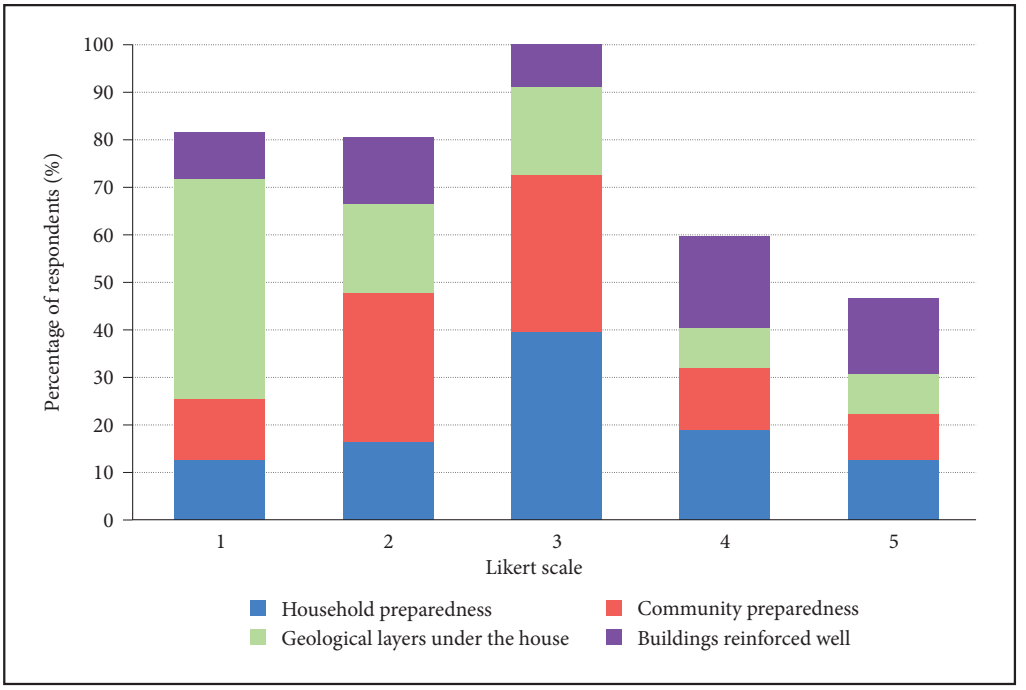

Figure 2: Percentage of respondents and related Likert scale value for perceived preparedness and household safety.

Table 2: Cross-tabulation between sex, age, and perceived preparedness and household safety variables

Variables	Descriptive		Sex				Age				
	M	*SD*	M %	F %	χ^2	*p*	χ^2	Y	MA	E	*p*
Household preparedness	3.02	1.16	32.8	30.0	10.1	**.038***	164.4	45.1	19.0	16.0	**.000****
Community preparedness	2.76	1.13	23.5	21.8	28.6	**.000****	184.5	30.4	14.1	10.0	**.000****
Geological layers under house	2.14	1.30	18.0	14.0	16.0	**.003***	136.1	15.2	26.4	28.0	**.000****
Earthquake-proof house	1.91	0.29	12.6	5.5	15.3	**.000****	39.8	14.8	8.5	2.0	**.000****
Reinforced house	1.29	0.45	64.1	76.7	20.4	**.000****	56.5	75.4	64.2	44.0	**.000****
Secured furniture to wall	1.94	0.36	22.3	8.0	41.7	**.000****	16.5	18.1	17.0	2.0	**.002***
Buildings reinforced well	3.17	1.16	36.7	24.6	15.9	**.003***	159.5	32.3	45.0	30.0	**.000****

Note: M = male, F = female, Y = young, MA = middle-aged, E = elderly.
**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).

4.2 Essential supplies

The results of the descriptive statistical analysis in this participant sample indicated that 67% of participants reported preparing an emergency kit, 49% examining the contents of the emergency kit regularly, 62% having easy access to an emergency kit, 37% having emergency stocks, 34% having sufficient stocks, and 40% that their community stored emergency supplies (Figure 3).

Chi-square analyses indicated that higher percentages of men than women reported the following: having easier access to an emergency kit, having emergency stock, and that the community stored emergency supplies. In contrast, a higher percentage of women than men reported the following: preparing an emergency kit, examining the contents of emergency kits, and ensuring stock sufficiency (Table 3). Women were again more active in carrying out preparedness, whereas men were more likely to have favorable perceptions of preparedness.

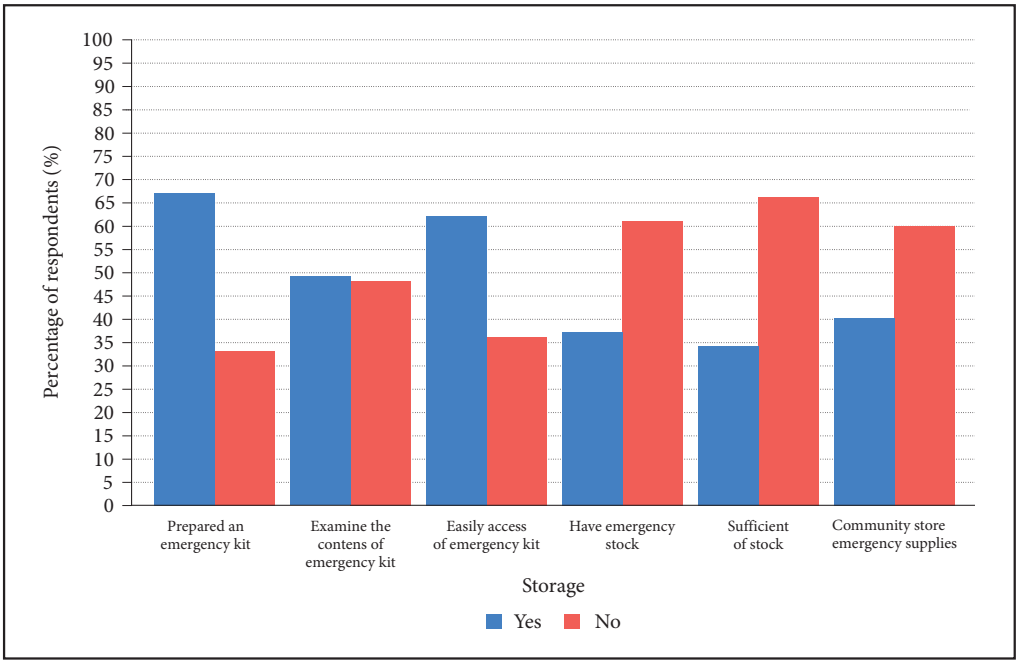

Figure 3: Descriptive statistical analysis regarding essential supplies.

Table 3: Cross-tabulation between sex, age, and essential supply variables

Variables	Descriptive		Sex				Age				
	M	*SD*	M %	F %	χ^2	*p*	χ^2	Y	MA	E	*p*
Prepared an emergency kit	1.33	0.47	61.8	70.7	24.2	**.000****	45.1	39.0	36.0	90.5	**.000****
Contents of emergency kit	1.55	0.50	47.1	52.2	4.6	.096	57.0	54.0	36.0	27.9	**.000****
Easily access of emergency kit	1.37	0.48	66.1	59.9	4.0	**.050***	68.9	64.0	55.1	26.0	**.000****
Have emergency stock	1.62	0.48	41.6	35.1	4.5	**.033***	44.7	28.0	25.0	45.2	**.000****
Sufficient stock	2.11	1.17	7.0	12.6	23.9	**.000****	28.3	44.3	36.7	292.2	**.000****
Communal emergency supplies	1.59	0.49	34.0	46.7	11.7	**.001****	57.8	20.6	17.0	119.6	**.000****

Note: M = male, F = female, Y = young, MA = middle-aged, E = elderly.
**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).

This study found that higher percentages of young people reported the following: preparing an emergency kit, having easy access to an emergency kit, having an emergency stock, and that their community stored emergency supplies. In contrast, a higher percentage of middle-aged people reported the following: examining the contents of emergency kits and ensuring stock sufficiency (Table 3).

4.3 Shelter following an earthquake

In terms of sex differences, a higher percentage of males than females reported the following: knowing the route to the shelter, being familiar with the obstacles on the route to the shelter, awareness of the conditions of a provided anticipated shelter, and being familiar with the shelter management. In contrast, and consistent with the pattern of findings thus far on behavior-related sex differences, a higher percentage

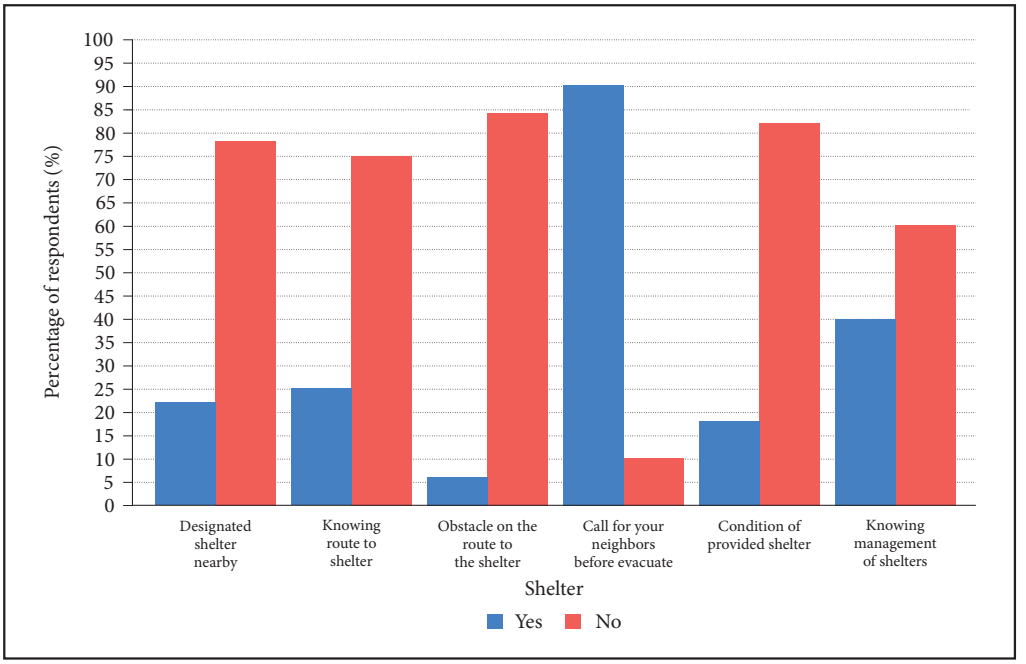

Figure 4: Descriptive statistical analysis regarding shelters.

Table 4: Cross-tabulation between sex, age, and shelter variables

Variables	Descriptive		Sex				Age				
	M	*SD*	M %	F %	χ^2	*p*	χ^2	Y	MA	E	*p*
Designated shelter nearby	1.77	0.41	24.0	21.0	1.91	.166	34.6	31.0	16.9	104.4	**.000****
Route to shelter	1.76	0.42	24.8	21.2	13.5	**.001****	35.9	30.0	14.0	126.3	**.000****
Obstacles on route to shelter	2.61	0.59	6.4	5.2	48.6	**.000****	8.4	1.0	4.1	135.2	**.000****
Calling neighbors	1.29	1.45	88.0	94.0	31.5	**.000****	86.9	97.0	100.0	101.5	**.000****
Condition of shelter	1.85	0.98	19.3	18.1	16.6	**.002***	28.3	22.2	12.7	0.3	.124
Management of shelters	2.34	2.94	13.0	7.8	51.3	**.000****	19.4	1.0	2.5	84.9	**.000****

Note: M = male, F = female, Y = young, MA = middle-aged, E = elderly.
**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).

of women than men reported that they would call their neighbors before evacuating. Regarding age effects, a higher percentage of young people reported knowing the route to the shelter, having a designated shelter nearby, being aware of obstacles on the route to an anticipated shelter, being aware of the conditions of an anticipated shelter, and being familiar with the shelter management. In contrast, a higher percentage of older adults reported that they would call their neighbors before evacuating (Table 4; Figure 4).

4.4 Support and assistance

Research has found that just under half (44%) could name an individual that would require special care in the event of a disaster. This included 31% of the total sample that reported having knowledge of older adults, the disabled, or infants that might require support and assistance; 26% reported having knowledge

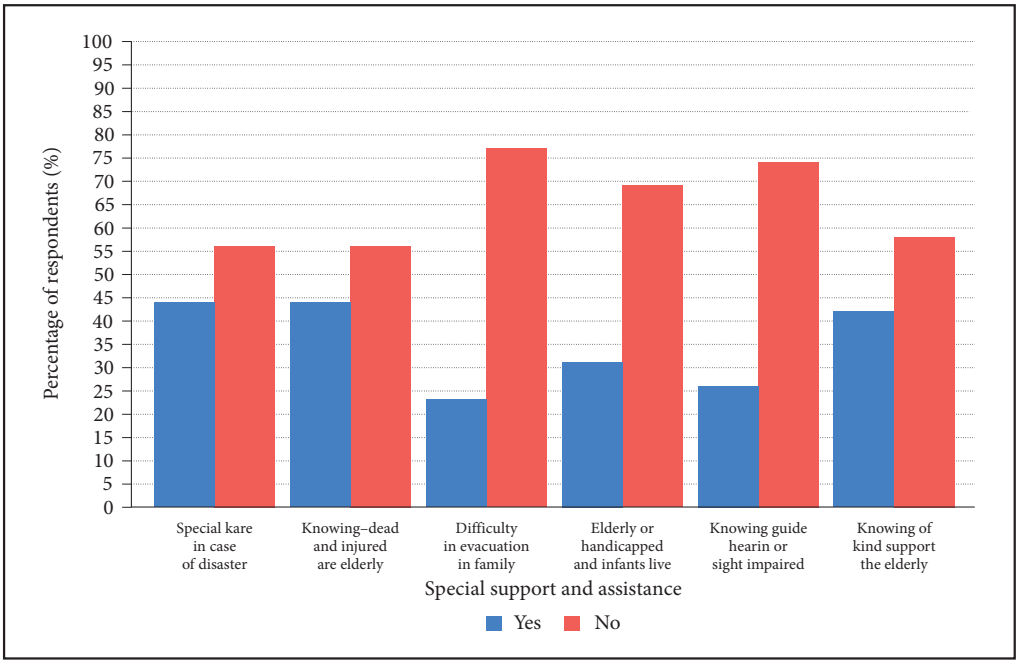

Figure 5: Descriptive statistical analysis regarding special support and assistance.

Table 5: Cross-tabulation between sex, age, and special support and assistance variables

Variables	Descriptive		Sex				Age				
	M	*SD*	M %	F %	χ^2	*p*	χ^2	Y	MA	E	*p*
Special care in a disaster	1.90	0.88	36.0	51.1	57.5	**.000****	51.5	36.8	32.0	54.1	**.000****
Dead and injured elderly	3.39	1.45	38.1	46.0	32.2	**.000****	44.0	41.0	20.0	152.6	**.000****
Difficulty in family evacuation	1.76	0.42	21.3	24.9	8.9	**.030***	21.1	34.0	6.0	61.1	**.000****
Elderly, handicapped, infants	2.75	1.50	34.0	32.0	6.6	.156	26.3	36.8	62.0	0.30	.152
Hearing or visually impaired	2.63	1.50	22.1	29.2	13.3	**.010***	27.0	28.3	46.0	191.2	**.000****
How to support the elderly	3.22	1.41	24.9	47.7	45.9	**.000****	50.1	58.5	32.0	115.6	**.000****

Note: M = male, F = female, Y = young, MA = middle-aged, E = elderly.
**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).

of individuals with hearing or visual impairments; and 23% were aware of difficulties related to family evacuation. In terms of other findings here, 42% reported knowing what kind of support is needed by the elderly and 44% knowing that the elderly are more vulnerable to life-threatening injuries (Figure 5).

In terms of sex differences in relation to assistance and support factors, a higher percentage of women than men reported the following: knowing somebody that would need special care in the event of a disaster, anticipating difficulties in family evacuation, and knowing people with hearing or visual impairments that might require assistance. They also reported better knowledge of the kind of support required by the elderly, who are also more vulnerable (Table 5). A higher percentage of young people reported knowing somebody that would need special care in the event of a disaster and knowing that older adults are more vulnerable. A higher percentage of middle-aged people reported anticipating difficulties in family evacuation and being aware of the kind of support older adults might require. Finally, a higher percentage of older adults reported knowing people with hearing or visual impairments that might require assistance (Table 5).

5 Discussion

Many countries have promoted the idea that households should prepare essential survival items, make a plan, improve survival skills, and facilitate people's ability to cope with the consequences of an earthquake (Russell, Goltz and Bourque 1995; Spittal et al. 2008; Becker et al. 2012; Jamshidi et al. 2016). However, a number of national and international studies have shown that levels of earthquake preparedness are generally low (Russell, Goltz and Bourque 1995; Mileti and Darlington 1997; Ronan and Johnston 2005; Azim and Islam 2016). Motivating people to prepare can be a difficult task, and much research has identified specific demographic, socioeconomic, and psychological factors that predict preparedness behaviors (Russell, Goltz and Bourque 1995; Rossi 1990; Paton et al. 2010; Solberg, Rossetto and Joffe 2010; Johnson and Nakayachi 2017; Cvetković, Gačić and Ristanović 2018). Lack of social responsibility (e.g., insufficient insurance policies) can also be a very important factor in the preparedness process (Zorn and Komac 2015).

The findings on the mean estimates of households' preparedness (a somewhat low level) are consistent with some other studies (Russell, Goltz and Bourque 1995; Mileti and Darlington 1997; Spittal et al. 2008; Johnson and Nakayachi 2017). For example, a study about perceptions of earthquake preparedness of households in Saudi Arabia found that residents of Jeddah were mostly not prepared (Azim and Islam 2016). Similarly, this study showed that the highest percentage of respondents said their household is neither prepared nor unprepared to respond. This could be linked to the fact that Serbia does not have education strategies, an awareness program, drills, or a campaign for earthquakes. Devi and Sharma (2015) found that less than half of adults had adequate practice in earthquake preparedness in Nepal. Becker et al. (2012) found that household earthquake preparedness still remains at modest levels despite the importance of preparing (e.g., Napier, Wanganui, & Timaru in New Zealand). Ronan and Johnston (2005) also found that overall levels of earthquake preparation are universally low, including in risk-prone areas (e.g., California, Turkey, and Japan).

Taken together, the results of descriptive analyses showed that the largest percentage of respondents reported that the local community is unprepared for reaction, lacking knowledge about the geological layers under houses and not knowing whether the buildings are reinforced or whether they are earthquake-resistant. Given the overall low levels of preparedness, including relevant knowledge, this points to identification of the factors that can assist emergency management agencies and other disaster risk reduction and safety organizations to tailor communication to enhance knowledge, motivation, and specific preparedness activities. In contrast, in lower seismicity contexts, perceptions are typically lower.

Regarding the effects of sex, the findings in our study are mixed, which is consistent with some previous studies (e.g., Able and Nelson 1990). For example, a higher percentage of men felt that their households were prepared and, in contrast, a higher percentage of women checked their houses for earthquake resistance. The results can be related to certain studies that found that women are less likely to be prepared (Hackl, Halla and Pruckner 2007). Other research and reviews have supported the notion that in many households women often take more responsibility for household matters, including disaster preparedness (Ersing et al. 2015). In Serbia, men traditionally perform more physical labor, which may then have implications for household and community preparedness (Pešić 2006). On the other hand, women are traditionally

seen as housekeepers and childminders. Such findings, of course, have implications for preparedness communication, including specific guidance coupled with the notion of both women and men working together in household and community terms and possible enhanced effects of balancing levels of preparedness with reality. In addition, this combination of findings has implications for both planning shelters and preparedness communication within the community (Woersching and Snyder 2003; Liu, Ruan and Shi 2011).

Compared to middle-aged and elderly people, young people perceived the preparedness and household safety in a different way. These results are consistent with a previous study by Sattler, Kaiser, and Hittner (2000), which found a positive relationship between older age and personal disaster preparedness. Research has also found that older adults are typically more emotionally resilient to the effects of natural disasters, compared to younger people (Heller et al. 2005). Compared to middle-aged and young people, a higher percentage of elderly people also reported awareness of what kind of geological layers lie under the house. Based on this, it can be assumed that older people mostly built their own houses and as a result are more familiar with the characteristics of the area or have a fear of earthquakes.

Reasons for this may be previous experience, both general life experience as well as having experienced and coped with previous hazard events (Norris et al. 2002). Given this range of findings, emergency communication and education that features a cooperative, participatory approach may then benefit from the relative strengths and tendencies seen within different age cohorts.

Generally, the reasons for engaging in initial and sustained preparedness include people reporting a desire to be prepared and, over time, to keep their supplies fresh and/or in working order in case they have to use them. Protection motivation theory (Maddux and Rogers 1983) and theory of planned behavior (Ajzen 1991, 2011) may be used as a framework for understanding various preparedness behaviors. People that do replenish their emergency supplies report wanting to ensure they have safe drinking water and food (Page et al. 2008; Kapucu 2008; Becker et al. 2012). There are groups within any community that may require additional support and assistance following an earthquake (Tanida 1996; Matsuda and Okada 2006; WHO 2008; Cvetković, Milašinović and Lazić 2018). Often, however, marginal groups are not considered in disaster planning (Heller et al. 2005; Zorn 2018). In an urban area, earthquakes have been found to cause especially heavy damage to the inner-city housing of low-income people and the elderly (Hirayama 2000). This idea is buttressed by our findings that just under half could name an individual that would require special care during a disaster.

6 Conclusion

Taken together, this study contributes new information that can be used to assist in local and national emergency management communication to improve household earthquake preparedness. The fact that a relatively low number of participants in this study reported perceptions, knowledge, or actual preparedness behaviors suggests complacency in terms of earthquake prevention, mitigation, and preparedness in particular, and, in our opinion, low general readiness for a range of hazards. The importance of focusing on human risk perceptions, decision-making, and behavior processes in preparedness is a focal point of this study. Knowledge about the differences between social groups in terms of socioeconomic characteristics such as sex and age or health status is a precursor to tapping into the cognitive, emotional, and behavioral functioning of individuals in relation to prevention, mitigation, and preparedness for earthquakes and other hazards. Thus, these findings suggest demographic profiles in which some have relative strengths. A prominent example across the categories examined is that women reported more actual behavioral preparedness whereas men reported more perceptions and knowledge. Limitations of this study include the fact that the findings presented are mainly descriptive. Future research should evaluate not only individual factors, but also social and community factors. At the same time, the sample was reasonably large and as such it offered initial basic findings that can promote more detailed future investigations. Such future research should examine the factors that affect the preparedness for earthquakes and other events, and factors improving preparedness, including more psychological (e.g., self-efficacy and behavioral intentions) and social (e.g., collective helping) constructs. Such information might then be used as a starting point to design programs to improve household preparedness for earthquakes and other hazard events. A critical issue in emergency management education and communication is how to help a population, including those with increased vulnerability, and knowing how to respond during an earthquake to protect oneself and others. One inter-

national initiative, ShakeOut (Internet 1), could be used to help people not only learn more about protecting themselves effectively during an earthquake, but also to facilitate more effective preparedness. This initiative was used to assist over fifty-five million people more effectively prepare for earthquakes in 2016. In addition, it can be used for more extensive disaster risk reduction and education in classrooms (e.g., Johnson et al. 2014) and community settings (e.g., a national effort carried out regularly in New Zealand; Internet 2).

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